

Specification for

Low-voltage switchgear and controlgear —

**Part 5: Control circuit devices and
switching elements —**

**Section 1: Electromechanical control
circuit devices**

The European Standard EN 60947-5-1:1991 has the status of a
British Standard

ICS 29.120.60

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This British Standard, having been prepared under the direction of the Power Electrical Engineering Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 1 April 1992

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National foreword

This British Standard has been prepared under the direction of the Power Electrical Engineering Standards Policy Committee and is the English language version of EN 60947-5-1 “*Low-voltage switchgear and controlgear*” Part 5 “*Control circuit devices and switching elements*” Section 1 “*Electromechanical control circuit devices*”, including amendments A1, A2 and A12, published by the European Committee for Electrotechnical Standardization (CENELEC). It was derived by CENELEC from IEC 947-5-1:1990 and its corrigendum November 1991 published by the International Electrotechnical Commission (IEC). For ease of publication, some of the figures also include the French text.

The CENELEC changes included in the introduction of the European Standard have been implemented at the appropriate places in the text and are indicated by a sideline in the margin. Parts of the original IEC text that have been modified by CENELEC have been quoted in National annex NA.

This British Standard is to be read in conjunction with BS EN 60947-1 which identifies the general requirements for equipment for low-voltage switchgear and controlgear. The BS EN 60947 series comprises the following publications.

- *Part 1: General rules;*
- *Part 2: Circuit breakers;*
- *Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units;*
- *Part 4: Contactors and motor-starters;*
- *Section 1: Electromechanical contactors and motor-starters;*
- *Part 5: Control circuit devices and switching elements;*
- *Section 1: Electromechanical control circuit devices;*
- *Section 2: Proximity switches;*
- *Part 6: Multiple function equipment;*
- *Section 1: Automatic transfer switching equipment;*
- *Part 7: Ancillary equipment;*
- *Section 1: Terminal blocks and copper conductors.*

This British Standard supersedes the following British Standards which will be withdrawn on 1 September 1992.

BS 4794-1:1979

BS 4794-2.1:1977

BS 4794-2.2:1977

BS 4794-2.3 and BS 4794-2.4:1977

BS 4794-2.5 and BS 4794-2.6:1978

BS 4794-2.20:1982

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 68, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

EUROPEAN STANDARD

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EUROPÄISCHE NORM

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English version

Low-voltage switchgear and controlgear Part 5: Control circuit devices and switching elements Section 1 — Electromechanical control circuit devices

(includes amendments A1:1997, A2:1997 and A12:1997)
(IEC 947-5-1:1990 + A1:1994 + A2:1996, modified)

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commutation pour circuits de commande
Section un — Appareils électromécaniques
pour circuits de commande
(inclut les amendements A1:1997, A2:1997
et A12:1997)
(CEI 947-5-1:1990 + A1:1994 + A2:1996,
modifiée)

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Teil 5: Steuergeräte und Schaltelemente
Hauptabschnitt Eins — Elektromechanische
Steuergeräte
(enthält Änderungen A1:1997, A2:1997
und A12:1997)
(IEC 947-5-1:1990 + A1:1994 + A2:1996,
modifiziert)

This European Standard was approved by CENELEC on 1991-09-22. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

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Foreword

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 60947-5-1:1990 could be accepted without textual changes, has shown that no CENELEC common modifications were necessary for the acceptance as European Standard. The reference document was submitted to the CENELEC members for formal vote and was approved by CENELEC as EN 60947-5-1 on 23 September 1991.

This European Standard supersedes EN 50007:1981 and HD 420 S2:1988.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1992-09-01
- latest date of withdrawal of conflicting national standards (dow) 1997-10-01

Annexes designated “normative” are part of the body of the standard. In this standard, Annex ZA is normative.

For products which have complied with EN 50007:1981 or HD 420 S2:1988 before 1992-09-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1997-09-01.

Foreword to amendment A1

The text of amendment 1:1994 to the International Standard IEC 60947-5-1:1990, prepared by SC 17B, Low-voltage switchgear and controlgear, of IEC TC 17, Switchgear and controlgear, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A1 to EN 60947-5-1:1991 on 1996-07-02 without any modification.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-10-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1997-10-01

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given for information only. In this standard, Appendix C, Appendix F, Annex G, Annex H and Annex ZA are normative and Appendix A, Appendix B, Appendix D and Appendix E are informative. Annex ZA has been added by CENELEC.

Endorsement notice

The text of amendment 1:1994 to the International Standard IEC 60947-5-1:1990 was approved by CENELEC as an amendment to the European Standard without any modification.

Foreword to amendment A2

The text of document 17B/721/FDIS, future amendment 2 to IEC 60947-5-1:1990, prepared by SC 17B, Low-voltage switchgear and controlgear, of IEC TC 17, Switchgear and controlgear, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 60947-5-1:1991 on 1996-07-02.

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- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1997-10-01

Endorsement notice

The text of amendment 2:1996 to the International Standard IEC 60947-5-1:1990 was approved by CENELEC as an amendment to the European Standard without any modification.

Foreword to amendment A12

This amendment was prepared by the Technical Committee CENELEC TC 17B, Low-voltage switchgear and controlgear including dimensional standardization.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A12 to EN 60947-5-1:1991 on 1996-07-02.

NOTE There is no amendment A11 to EN 60947-5-1. The document which was originally so ratified was redesignated EN 60947-5-4.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-10-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1997-10-01

This amendment covers the requirements of EMC for electromechanical control circuit devices. It contains additional requirements corresponding to subclause 7.3 of EN 60947-1.

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Introduction

All subjects left “under consideration” in IEC 947-5-1 are not part of this European Standard.

This means that:

- in the following clauses the appropriate paragraphs or notes are to be deleted:
 - 7.7.2** Additional requirements for control switches suitable for isolation
 - 8.1.4** Sampling tests
- the text of clause **8.2** is to be replaced by:

“Sub-clause **8.2.4** of Part 1 applies”.

Up-to-date information concerning the subjects dealt with in these clauses can be obtained from the secretariat of CENELEC TC 17B.

Chapter 1. General requirements

1 General

The provisions of the general rules, IEC Publication 947-1, are applicable to this standard, where specifically called for. General rules, clauses and sub-clauses thus applicable, as well as tables, figures and appendices are identified by a reference to Part 1, e.g. Sub-clause **1.2.3**, Table IV or Appendix A of Part 1.

1.1 Scope

This standard applies to control circuit devices and switching elements intended for controlling, signalling, interlocking, etc., of switchgear and controlgear.

It applies to control circuit devices having a rated voltage not exceeding 1 000 V a.c. (at a frequency not exceeding 1 000 Hz) or 600 V d.c.

However for operational voltages below 100 V a.c. or d.c., see Note 2 of Subclause **4.3.1.1**.

This standard applies to specific types of control circuit devices such as:

- manual control switches, e.g. pushbuttons, rotary switches, foot switches, etc.;
- electromagnetically operated control switches, either time-delayed or instantaneous, e.g. contactor relays;
- pilot switches, e.g. pressure switches, temperature sensitive switches (thermostats), programmers, etc.;
- position switches, e.g. control switches operated by part of a machine or mechanism;
- associated control circuit equipment, e.g. indicator lights, etc.

NOTE 1 A control circuit device includes (a) control switch(es) and associated devices such as (an) indicator light(s).

NOTE 2 A control switch includes (a) switching element(s) and an actuating system.

NOTE 3 A switching element may be a contact element or a semiconductor element.

It also applies to specific types of switching elements associated with other devices (whose main circuits are covered by other standards) such as:

- auxiliary contacts of a switching device (e.g. contactor, circuit breaker, etc.) which are not dedicated exclusively for use with the coil of that device;
- interlocking contacts of enclosure doors;
- control circuit contacts of rotary switches;
- control circuit contacts of overload relays.

Requirements pertaining to particular types of control circuit devices are dealt with in chapters 2 and 3. Contactor relays shall also meet the requirements and tests of IEC Publication 947-4-1 except for the utilization category which shall comply with this standard.

This standard does not include the relays covered in IEC Publication 255 or automatic electrical control devices for household and similar purposes.

The colour requirements of indicator lights, pushbuttons, etc., are found in IEC Publication 73 and also in Publication 2 of the International Commission of Illumination (CIE).

1.2 Object

The object of this section is to state:

- 1) The characteristics of control circuit devices.
- 2) The electrical and mechanical requirements with respect to:
 - a) The various duties to be performed.
 - b) The significance of the rated characteristics and of the markings.
 - c) The tests to verify the rated characteristics.
- 3) The functional requirements to be satisfied by the control circuit devices with respect to:
 - a) Environmental conditions, including those of enclosed equipment.
 - b) Dielectric properties.
 - c) Terminals.

2 Definitions

Clause 2 of Part 1 applies with the following additions listed in Sub-clauses 2.1 to 2.4 inclusive.

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2.1 Basic definitions

2.1.1 control circuit device

an electrical device intended for the controlling, signalling, interlocking, etc., of switchgear and controlgear

NOTE Control circuit devices may include associated devices dealt with in other standards, such as instruments, potentiometers, relays, in so far as associated devices are used for the purposes specified above.

2.1.2 control switch (for control and auxiliary circuits)

a mechanical switching device which serves the purpose of controlling the operation of switchgear or controlgear, including signalling, electrical interlocking, etc.

NOTE 1 A control switch consists of one or more contact elements with a common actuating system.

NOTE 2 This definition differs from IEV 441-14-46 since a control switch may include semiconductor elements or contact elements (see Sub-clauses 2.3.2 and 2.3.3).

2.1.3 control switch suitable for isolation

a control switch which, in the open position, complies with the requirements specified for the isolating function (see Sub-clauses 2.1.19 and 7.2.3.1 b) of Part 1)

NOTE Such control switches are intended to provide a higher degree of safety to personnel when working on the equipment controlled. For this reason, they have to be manually actuated relying on the intelligence of instructed persons to react in case they would fail to operate, e.g. in case of insufficiently opened contacts.

2.1.4 control station (IEV 441-12-08)

an assembly of one or more control switches fixed on the same panel or located in the same enclosure

NOTE A control station panel or enclosure may also contain related equipment, e.g. potentiometers, signal lamps, instruments, etc.

2.2 Control switches

2.2.1 automatic control switches

NOTE Automatic control switches are operated by automatic control (see Sub-clause 2.4.5 of Part 1). They are also designated as *pilot switches* (see Sub-clause 2.2.18 of Part 1).

2.2.1.1 instantaneous contactor relay (IEV 441-14-36)

a contactor relay operating without any intentional time delay

NOTE Unless otherwise stated, a contactor relay is an instantaneous contactor relay.

2.2.1.2 time-delay contactor relay (IEV 441-14-37)

a contactor relay with specified time-delay characteristics

NOTE 1 The time-delay may be associated with energization (*e*-delay) or with de-energization (*d*-delay) or both.

NOTE 2 A time-delay contactor relay may also incorporate instantaneous contact elements.

2.2.1.3**position switch** (IEV 441-14-49)

a pilot switch the actuating system of which is operated by a moving part of the machine, when this part reaches a predetermined position

2.2.1.4**programmer**

a control switch having a multiplicity of switching elements which, after initiation, operates in a defined sequence

2.2.2**manually operated control switches**

NOTE Manually operated control switches are operated by manual control (see Sub-clause 2.4.4 of Part 1).

2.2.2.1**push-button** (IEV 441-14-53)

a control switch having an actuator intended to be operated by force exerted by a part of the human body, usually the finger or palm of the hand, and having stored energy (spring) return

2.2.2.2**pull-button**

a control switch having an actuator intended to be operated by manual pull, and having stored energy (spring) return

2.2.2.3**push-pull button**

a control switch having an actuator intended to be operated by manual push and returned to its initial position by manual pull, or vice versa

NOTE There are also <<push-push>> or <<push-turn>> or other combinations of buttons.

2.2.2.4**rotary button** (e.g.: selector switch)

a combination of push-button type switching elements having an actuator operated by a manual rotation (see also Sub-clauses 2.2.2.15 – 2.2.2.18 inclusive)

NOTE A rotary push-button may have more than two positions; it may or may not have a spring return.

2.2.2.5**latched push-button**

a push-button with spring return, but which remains in the actuated position until a latch is released by a separate action

NOTE The latching may be released by subsequent actuation (such as pushing, turning, etc.) of the same or of an adjacent push-button or by the action of an electromagnet, etc.

2.2.2.6**locked push-button**

a push-button which may be secured in one or more of its positions by a separate action

NOTE The locking may be obtained by turning the button, by turning a key, by operating a lever, etc.

2.2.2.7**key-operated push-button**

a push-button which can only be operated as long as a key remains inserted

NOTE Key withdrawal may be provided at any position.

2.2.2.8**time-delay push-button**

a push-button the contacts of which return to the initial position only after a pre-determined interval of time following the release of the actuating force

2.2.2.9

delayed action push-button

a push-button in which the switching operation does not occur until after the force on the button has been maintained for a pre-determined interval of time

2.2.2.10

illuminated push-button

a push-button incorporating a signalling lamp in the button

2.2.2.11

covered push-button

a push-button in which the button is protected against inadvertent operation by a lid or a cover

2.2.2.12

shrouded push-button

a push-button in which the button is protected against inadvertent operation in certain directions

2.2.2.13

free push-button

a push-button in which the rotation of the actuator around its axis is not limited

2.2.2.14

guided push-button

a push-button in which the rotation of the actuator around its axis is prevented

NOTE Examples of guided push-buttons: the actuators of which are keyed, square or rectangular, etc.

2.2.2.15

rotary control switch (abbreviation: rotary switch)

a control switch having an actuator intended to be operated by rotation

2.2.2.16

key-operated rotary switch

a rotary switch where a key is used as the actuator

NOTE Key withdrawal may be provided at any position.

2.2.2.17

limited movement rotary switch

a rotary switch with a restricted angular movement of its actuator

2.2.2.18

unidirectional movement rotary switch

a rotary switch in which the actuating system allows rotation in one direction only

2.2.2.19

joy stick

a control switch having an actuator consisting of a pin or stick projecting essentially at a right angle from the panel or enclosure when in one of its positions and intended to be operated by angular displacement

NOTE 1 A joy stick may have more than two positions associated with different directions of the displacement of the stick and operating the contact elements differently: such a joy stick is referred to as a joy stick selector.

NOTE 2 The pin or stick may or may not have a spring return.

2.2.2.20

wobble stick

a joy stick which operates all contact elements alike, whatever be the direction of the displacement

2.2.2.21

foot-switch (pedal) (IEV 441-14-52 modified)

a control switch having an actuator intended to be operated by force exerted by a foot

2.3 Parts of control switches

2.3.1

switching element

a switching element may be a semiconductor element (see Sub-clause 2.3.2) or a contact element (see Sub-clause 2.3.3)

2.3.2

semiconductor element

an element designed to switch the current of an electric circuit by means of the controlled conductivity of a semiconductor

2.3.3 Contact element (of a control switch)

The parts, fixed and movable, conducting and insulating, of a control switch necessary to close and open one single conducting path of a circuit.

NOTE 1 The contact element and the actuating system may form an indivisible unit, but frequently one or more contact elements may be combined with one or more actuating system or systems. The actuating systems may be different.

NOTE 2 Definitions relating to various kinds of contact elements are given in Sub-clauses 2.3.3.1 to 2.3.3.10 inclusive.

NOTE 3 This definition does not include control coils and magnet systems.

The following definitions refer to a single contact element of a control switch:

2.3.3.1

single gap contact element [see Figure 4a), and Figure 4c)]

a contact element which opens or closes the conducting path of its circuit on one location only

2.3.3.2

double gap contact element [see Figure 4b), Figure 4d) and Figure 4e)]

a contact element which opens or closes the conducting path of its circuit in two locations in series

2.3.3.3

make-contact element (normally open)

a contact element which closes a conducting path when the control switch is actuated

2.3.3.4

break-contact element (normally closed)

a contact element which opens a conducting path when the control switch is actuated

2.3.3.5

change-over contact elements [see Figure 4c), Figure 4d) and Figure 4e)]

a contact element combination which includes one make-contact element and one break-contact element

2.3.3.6

pulse (fleeting) contact element

a contact element which opens or closes a circuit for a part of the travel during the transition of the actuator from one position to another

2.3.3.7

electrically separated contact elements (IEV 441-15-24)

contact elements belonging to the same control switch, but adequately insulated from each other so that they can be connected into electrically separated circuits

2.3.3.8

independent (snap) action contact element

a contact element of a manual or automatic control device in which the velocity of contact motion is substantially independent of the velocity of motion of the actuator

2.3.3.9

dependent action contact element

a contact element of a manual or automatic control device in which the velocity of contact motion depends on the velocity of motion of the actuator

2.3.3.10

contact unit

a contact element or contact element combination which can be combined with similar units operated by a common actuating system

2.3.4 Button

The external end of the actuator of a push-button, to which the actuating force is applied.

2.3.4.1

flush-button

a button which is substantially level with the adjacent fixed surrounding surface when in its initial position and is below this surface when it is operated

2.3.4.2

recessed button

a button which is below the adjacent fixed surrounding surface in both its initial and operated positions

2.3.4.3

extended button

a button which protrudes above the adjacent fixed surrounding surface both in its initial position and in its operated position

2.3.4.4

mushroom button

a button, the protruding end of which has an enlarged diameter

2.3.5

locating mechanism (of a rotary switch)

that part of the actuating system which retains the actuator and/or the contact elements in their positions

2.3.6

end stop

a device that limits the travel of a moving part

NOTE An end stop may relate either to the actuator or to the contact element.

2.4 Operation of control switches

2.4.1 Operation of contactor relays

2.4.1.1

e-delay (of a contact element)

a delay in the operation of a contact element of a contactor relay, following the energization of the coil of the electromagnet of this contactor relay

example: delay to close make-contacts (ON delay).

2.4.1.2

d-delay (of a contact element)

a delay in the operation of a contact element of a contactor relay, following the de-energization of the coil of the electromagnet of this contactor relay

Example: delay to open make-contacts (OFF delay).

Note for sub-clauses 2.4.1.1 and 2.4.1.2. The terms “e-delay” and “d-delay” may be applied to any kind of contact elements (see Sub-clause 2.3.3).

2.4.1.3

fixed delay (of a contact element)

a delay in the operation of a contact element of a contactor relay, which is not intended to be adjusted in value

2.4.1.4**adjustable delay (of a contact element)**

a delay in the operation of a contact element of a contactor relay, which is intended to be adjusted to different values after the installation of the contactor relay

2.4.2 Operation of pilot switches**2.4.2.1****actuating quantity**

the physical quantity, the value of which is decisive for the actuation or non-actuation of a pilot switch

2.4.2.2**operating value**

the value of the actuating quantity which is sufficient to cause a pilot switch to be actuated

2.4.2.3**return value**

the value of the actuating quantity which has to be re-established in order to cause an actuated pilot switch to return to its position of rest

2.4.2.4**differential value**

the difference between the operating value and the return value

2.4.3 Operation of rotary switches**2.4.3.1****definite position (abbreviation: position) (of a rotary switch)**

a position into which the locating mechanism pulls the rotary switch and retains it as long as the actuating moment does not exceed a certain value

2.4.3.2**position of rest**

a stable (definite) position into which the locating mechanism tends to move back and retain the rotary switch by stored energy

2.4.3.3**transit position**

a (definite) position in which the locating mechanism produces an intended marked change in the operating moment, but in which the actuator cannot remain by itself

2.4.3.4**biased position**

a (definite) position of a rotary switch in which the actuator is pulled against a stop from which it will return to a position of rest by means of stored energy (for example, by means of a spring)

NOTE During the transfer from a biased position to the adjacent position of rest, the rotary switch may pass through one or more transit positions.

2.4.3.5**latched position**

a biased position in which the return mechanism is held by a latching arrangement

NOTE The latching arrangement may be released manually or otherwise.

2.4.3.6**locked position**

a (definite) position in which a rotary switch is secured by separate action

NOTE The locking may be obtained by turning a key, operating a lever, etc.

2.4.3.7**operating diagram**

the representation of the intended order in which the contact elements of a rotary switch operate as a result of actuation

2.4.4 Operation of mechanically operated control switches

2.4.4.1

pre-travel of the actuator (dimension a on Figure 2)

the maximum travel of the actuator which causes no travel of the contact elements

2.4.4.2

over-travel of the actuator

the travel of the actuator after all the contacts have reached their closed (open) position

2.4.4.3

direct drive

a connection between actuator and contact element that excludes any pre-travel of the actuator

2.4.4.4

positive drive

a connection between actuator and contact element such that the force applied to the actuator is directly transmitted to the contact element

2.4.4.5

limited drive

a connection between actuator and contact element that limits the force transmitted to the contact element

2.4.4.6

minimum starting force (or moment)

the smallest value of force (or moment) initiating the pre-travel of the actuator

2.4.4.7

minimum actuating force (or moment)

the minimum value of the force (or moment) to be applied to the actuator that will cause all contacts to reach their closed (open) position

2.4.4.8

pre-travel of the contact element (dimension b on Figure 2)

the relative movement which occurs within the contact element before the contacts make (break)

2.4.4.9

over-travel of the contact element (dimension d on Figure 2)

the relative movement which occurs within the contact element after the contacts have reached the make (break) position

2.4.4.10

bounce time (IEV 446-17-13)

for a contact which is closing (opening) its circuit, the time interval between the instant when the contact circuit first closes (opens) and the instant when the circuit is finally closed (opened)

3 Classification

3.1 Contact elements

Contact elements may be classified as follows:

- 1) Utilization categories (see Sub-clause 4.4).
- 2) Electrical ratings based on utilization categories (see Appendix A).
- 3) One of the following form letters (see Figure 4):
 - a) Form A — Single gap make-contact element.
 - b) Form B — Single gap break-contact element.
 - c) Form C — Single gap make-break three terminal change-over contact element.
 - d) Form X — Double gap make-contact element.
 - e) Form Y — Double gap break-contact element.

f) Form Z — Double gap make-break four terminal change-over contact element.

4) Other types not included in 3).

NOTE 1 Regarding Figure 4e), the two moving contact elements are electrically separated (see Sub-clause 2.3.3.7).

NOTE 2 Distinction is made between make before break (overlap) change-over contact elements where the two circuits are both closed for a part of the travel of the moving contacts from one position to the other, and break before make (non-overlap) change-over contact elements where the two circuits are both open for a part of the travel of the moving contacts from one position to the other. Unless otherwise stated, change-over contact elements are break before make.

3.2 Control switches

Control switches may be classified according to the contact element and the nature of the actuating system, e.g. push-buttons, Form X.

3.3 Control circuit devices

Control circuit devices may be classified according to the control switch and the associated control circuit equipment, e.g. push-buttons plus indicator lights.

3.4 Time delay switching elements

Distinction is made according to how the time delay of a switching element is achieved, e.g. electrical delay, magnetic delay, mechanical delay, or pneumatic delay.

3.5 Control switch mounting

The control switch mounting may be classified by the mounting hole size, e.g. D12, D16, D22, D30 (see Sub-clause 6.3.1).

4 Characteristics

4.1 Summary of characteristics

The characteristics of control circuit devices and switching elements should be stated in the following terms, where such terms are applicable:

- type of equipment (see Sub-clause 4.2);
- rated and limiting values for switching elements (see Sub-clause 4.3);
- utilization categories of switching elements (see Sub-clause 4.4);
- normal and abnormal load characteristics (see Sub-clause 4.3.5);
- switching overvoltages (see Sub-clause 4.9).

4.1.1 Operation of a control switch

The principal application of a control switch is the switching of loads as indicated for the various utilization categories in Table I.

Other applications, e.g. the switching of tungsten filament lamps, small motors, etc., are not dealt with in detail in this standard, but are mentioned in Sub-clause 4.3.5.2.

4.1.1.1 Normal conditions of use

The normal use of a control switch is to close, maintain and open circuits in accordance with the utilization category shown in Table I. Also refer to Table IV.

4.1.1.2 Abnormal conditions of use

Abnormal conditions may arise, for example, when an electromagnet, although energized, has failed to close. Refer to Table V.

A control switch shall be able to break the current corresponding to such conditions of use.

4.2 Type of control circuit device or switching element

The following shall be stated:

4.2.1 Kind of control circuit device

- manual control switches, e.g. push-buttons, rotary switches, foot switches, etc.;
- electromagnetically operated control switches, either time delayed or instantaneous, e.g. contactor relays;

- pilot switches, e.g. pressure switches, temperature sensitive switches (thermostats), programmers, etc.;
- position switches;
- associated control circuit equipment, e.g. indicator lights, etc.

4.2.2 *Kind of switching elements*

- auxiliary contacts of a switching device (e.g. contactor, circuit breaker, etc.) which are not dedicated exclusively for use with the coil of that device;
- interlocking contacts of enclosure doors;
- control circuit contacts of rotary switches;
- control circuit contacts of overload relays.

4.2.3 *Number of poles*

4.2.4 *Kind of current*

a.c. or d.c.

4.2.5 *Interrupting medium*

Air, oil, gas, vacuum, etc.

4.2.6 *Operating conditions*

4.2.6.1 *Method of operation*

Manual, electromagnetic, pneumatic, electro-pneumatic.

4.2.6.2 *Method of control*

- automatic;
- non-automatic;
- semi-automatic.

4.3 *Rated and limiting values for switching elements*

The rated values established for the switching elements of a control circuit device shall be stated in accordance with Sub-clause 4.3.1 to 4.3.5 inclusive but it is not necessary to specify all the values listed.

4.3.1 *Rated voltages* (of a switching element)

A switching element is defined by the following rated voltages:

4.3.1.1 *Rated operational voltage (U_e)*

Sub-clause 4.3.1.1 of Part 1 applies with the following additions:

For 3 phase circuits, U_e is stated as r.m.s. voltage between phases.

NOTE 1 A switching element may be assigned a number of combinations of rated operational voltage and rated operational current.

NOTE 2 Control switches dealt with in this standard are not normally intended to be used at very low voltages and they may not be suitable for such a service. It is therefore recommended to seek the advice of the manufacturer concerning any application with a low value of operational voltage, e.g. below 100 V a.c. or d.c.

4.3.1.2 *Rated insulation voltage (U_i)*

Sub-clause 4.3.1.2 of Part 1 applies.

4.3.1.3 *Rated impulse withstand voltage (U_{imp})*

Sub-clause 4.3.1.3 of Part 1 applies.

4.3.2 *Currents*

A switching element is characterized by the following currents:

4.3.2.1 *Conventional free air thermal current (I_{th})*

Sub-clause 4.3.2.1 of Part 1 applies.

4.3.2.2 *Conventional enclosed thermal current (I_{the})*

Sub-clause 4.3.2.2 of Part 1 applies.

4.3.2.3 Rated operational current (I_o)

The first paragraph of Sub-clause 4.3.2.3 of Part 1 applies.

4.3.3 Rated frequency

Sub-clause 4.3.3 of Part 1 applies.

4.3.4 Vacant**4.3.5 Normal and abnormal load characteristics****4.3.5.1 Rated making and breaking capacities and behaviour of switching elements under normal conditions**

A switching element shall comply with both requirements given in Table IV corresponding to the assigned utilization category and the requirements according to the rated operational voltage.

NOTE 1 For a switching element to which a utilization category is assigned, it is not necessary to specify separately a making and breaking capacity.

NOTE 2 A switching element used for the switching of small motors and tungsten filament lamp loads shall be assigned a utilization category given in IEC Publication 947-4-1 and comply with the appropriate corresponding requirements in that publication.

4.3.5.2 Making and breaking capacities under abnormal conditions

A switching element shall comply with the requirements given in Table V corresponding to the assigned utilization category.

NOTE An example of an abnormal condition of use is one where the electromagnet does not operate and the switching elements have to interrupt the making current.

4.3.6 Short-circuit characteristics**4.3.6.4 Rated conditional short-circuit current**

Sub-clause 4.3.6.4 of Part 1 applies.

4.4 Utilization categories for switching elements

The utilization categories as given in Table I are considered standard. Any other types of application shall be based on agreement between manufacturer and user, but information given in the manufacturers' catalogue or tender may constitute such an agreement.

Table I — Utilization categories for switching elements

Kind of current	Category	Typical applications
Alternating current	AC-12	Control of resistive loads and solid state loads with isolation by opto couplers
	AC-13	Control of solid state loads with transformer isolation
	AC-14	Control of small electromagnetic loads (≤ 72 VA)
	AC-15	Control of electromagnetic loads (> 72 VA)
Direct current	DC-12	Control of resistive loads and solid state loads with isolation by opto couplers
	DC-13	Control of electromagnets
	DC-14	Control of electromagnetic loads having economy resistors in circuit

4.5 Vacant**4.6 Vacant****4.7 Vacant****4.8 Vacant****4.9 Switching overvoltages**

Sub-clause 4.9 of Part 1 applies.